Interactive Data Analysis, Modeling, and Simulation: Available Now On a Desktop Near You

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This electronic poster will illustrate the use of two powerful "off-the-shelf" tools for the transformation of data into information in a medical center setting. We have used these tools for clinical, research, and educational applications and have found them very useful not only for extending the mathematical capabilities of the individual user, but also for improving communications among users from diverse disciplines. Two important features shared by both programs are ease of use and effective information presentation and display. These features allow the user to concentrate on the formulation of the problem, leaving the tedious part of the problem solution for the computer.

The first program, ***Mathematica®****, is a "system for doing mathematics by computer."* ***Mathematica®*** *supports users with a wide range of mathematical sophistication in the solution of problems which have been formulated in "standard" mathematical format. The second program,* ***ithink™****, is used to create simulations of processes and to facilitate "what-if" analysis by presenting process variables in graphical or tabular form. The unique feature of* ***ithink™*** *is that the simulation builder /user specifies the relationships between process elements while the application supplies the "mathematics" to carry out the simulation. We have found* ***ithink™*** *to be a powerful tool not only for testing the predictions of completed models but also for the process of developing the models themselves. This is especially true in modeling processes which require input from several disciplines, where developers can see the results of their contributions in interactive "runs" of the process simulation.*

The insights gained from the collection and analysis of data associated with a given phase or stage of a process frequently lead to questions which may suggest a reformulation of the basic model. If the reformulation requires much "higher math", the development cycle is often extended due to the need for additional "expertise". In much the same way that "word processing" and "spreadsheets" amplified the capabilities of the end user to develop their subject-matter expertise, these programs extend the capability to create and validate mathematical models to the end-user.

APPLICATIONS

Modeling and Simulation
These applications, developed in **ithink™**, were formulated with input from subject matter "experts" who developed the simulations in an interactive manner.

Ambulatory Care Clinic Service: The relationships between patients served and various clinic parameters were studied, with results presented in graphical form.

Tracer Kinetics: The effects of physical decay and biological elimination are simulated in a manner which allows students to see the effects of varying model parameters.

Spread of Disease: The differential equations used to specify a model for the spread of AIDS were used to build a "compartment" model in which the mathematics required for the simulation were automatically produced.

Disk Storage Utilization for Data Archiving: In this simulation, the effects of various archiving strategies were studied with projections for disk storage requirements presented in both graphical and tabular form.

Computation and Analysis
Mathematica® was used to analyze data imported from the medical center hospital information system and to present the information in both hard-copy and animated displays.

Presentation of Bed Usage Data: Bed utilization data by service on a daily basis was analyzed for a two year period for trends and patterns.

Clinical Decision Making: Electronic notebooks for teaching basic decision making were developed and used for teaching Bayesian decision strategies.

Clinical Information Processing: Notebooks were developed to process "count" data from nuclear medicine studies, performing appropriate corrections and presenting results in graphical format.

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